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REPORT BY THE  
**Comptroller General**  
OF THE UNITED STATES

**Department Of Energy's Safety And Health  
Program For Enrichment Plant Workers  
Is Not Adequately Implemented**

The Department of Energy's (DOE's) program to protect the safety and health of employees at its contractor-operated uranium enrichment plants has not been fully implemented by DOE's Oak Ridge Operations Office. Appraisals and inspections of plant conditions are not as frequent and/or as thorough as required. Instead of independently investigating employee complaints, DOE has delegated this responsibility to the contractor.

The Secretary of Energy should make sure that Oak Ridge properly conducts inspections and appraisals and investigates and follows up on all employee complaints. He should also take steps to provide increased independence and objectivity in the Oak Ridge Operations Office's safety and health program. Furthermore, the Congress should authorize the Secretary of Energy to institute a program of non-reimbursable penalties and fines for violations of safety and health standards and procedures.

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COMPTROLLER GENERAL OF THE UNITED STATES

WASHINGTON, D.C. 20548

B-199279

The Honorable John <sup>H.</sup> Glenn  
Chairman, Subcommittee on Energy,  
Nuclear Proliferation and  
Federal Services  
Committee on Governmental Affairs  
United States Senate

SEN 0660Y

Dear Mr. Chairman:

Your January 3, 1980, letter requested that we evaluate the Department of Energy's program for ensuring the safety and health of workers at the Department's three uranium enrichment plants. This resultant report focuses on three areas of program implementation: the adequacy of the Department's appraisals of contractor health and safety programs, inspections of plant conditions, and investigation of employee complaints.

As arranged with your office, further distribution of this report will not be made until your Subcommittee hearing on the subject.

Sincerely yours,

Comptroller General  
of the United States

AGC 00912  
AGC 01475



COMPTROLLER GENERAL'S REPORT  
TO THE CHAIRMAN, SUBCOMMITTEE  
ON ENERGY, NUCLEAR PROLIFERA-  
TION AND FEDERAL SERVICES,  
SENATE COMMITTEE ON GOVERN-  
MENTAL AFFAIRS

DEPARTMENT OF ENERGY'S  
SAFETY AND HEALTH PROGRAM  
FOR ENRICHMENT PLANT WORKERS  
IS NOT ADEQUATELY IMPLEMENTED

D I G E S T

Although the Department of Energy (DOE) has designed a comprehensive program to ensure the health and safety of employees at the Nation's three Government-owned, contractor-operated uranium enrichment plants, its Oak Ridge Operations Office has not effectively implemented the program.

Injury records for the three enrichment plants are better than injury statistics for similar operations, such as the chemical industry, and radiation exposure records for the three plants indicate that employees are receiving less than maximum allowable doses. However, historical statistics may be somewhat misleading because DOE's current oversight of safety and health at the enrichment plants is not achieving the coverage required by the program. This is at least partially attributable to a shortage of safety and health staff at the Oak Ridge Operations Office. (See p. 25.)

DOE's program for safety and health oversight and enforcement at the three plants relies primarily on a three-layered system: (1) inspections, (2) appraisals of the contractor's operations, and (3) investigations of employee complaints. But DOE's Oak Ridge Operations Office has not conducted inspections and appraisals as frequently as required. In addition, when employees have exhausted the potential for in-house resolution of safety and health complaints and formally complained to DOE, the Operations Office has referred many complaints back to the contractor for resolution. Further, the Operations Office has done little to see that changes recommended as a result of complaint investigations are carried out.

SAFETY AND HEALTH  
INSPECTIONS NOT CONDUCTED

Although physical inspections of conditions, at each plant are required annually, DOE had conducted only five inspections at the three enrichment plants during the past 4 years. When inspections have been conducted, they have not included checking radiation levels in the plant. Thus, DOE cannot be sure that it is aware of potential hazards and take prompt action to eliminate or mitigate the risk of accidents. A March 7, 1978, release of more than 10 tons of liquid uranium hexafluoride from a ruptured storage cylinder at the Portsmouth, Ohio, enrichment plant may have been avoided, had the Department conducted on-site inspections and discussed safety and health concerns with employees. (See pp. 21 and 22.)

APPRAISALS SHOULD FOCUS  
ON PROBLEM AREAS

Appraisals--reviews of the operating contractors' safety and health programs--have been conducted more frequently than inspections, but not as often as necessary. Moreover, these appraisals have failed to focus on major problem areas, many of which had been identified in employee complaints.

For example, the Operations Office received two complaints concerning mislabeling or lack of labeling to warn employees of contaminated equipment at the Oak Ridge enrichment plant. Although the Operations Office agreed that a problem existed and suggested that the contractor establish and implement new procedures, the Operations Office's ensuing appraisal did not review this area. Sometime later, a similar complaint was again made to DOE. Even then, the appraisal conducted after this third complaint still did not address the problem area. (See pp. 22 through 25.)

EMPLOYEE SAFETY AND HEALTH  
COMPLAINTS SHOULD RECEIVE  
MORE ATTENTION

Employees with complaints are encouraged to seek resolution with the operating contractor. If the complaint is not resolved at that level, the employee may file a complaint with the Operations Office. In many cases, DOE has delegated complete responsibility for handling complaints received by DOE to the contractors. Referral to the contractor only sends the employee back to a situation from which he previously did not obtain resolution. If DOE's program is to ensure employee safety and health protection, it is imperative that the employee be offered an objective, independent review of his complaint and that the complaint not be recycled to the contractor. (See pp. 16 and 17.)

The Oak Ridge Operations Office is not adequately following up on changes recommended as a result of occupational safety and health complaints from employees at enrichment plants. Although DOE's procedures do not require such follow ups, they would be an effective safety and health tool, as well as a good management practice.

DOE procedures require a written response to each contractor employee filing a complaint, explaining the results of the investigation or stating why no investigation was made. The Oak Ridge Operations Office did not provide a written response to 27 of the 92 complaints on file from enrichment plant employees.

In cases where the Operations Office is at least partially in agreement with the complaint, it is important that the employee be informed of the action taken. In cases where no suggestions are forwarded to the contractor, it is equally important that the employee be informed as to why no changes are being recommended and what his rights of appeal are. (See p. 20.)

Oak Ridge Operations Office safety and health officials cite staff shortages as the primary reason for the lack of inspections and inadequate appraisals and complaint coverage. GAO's review of safety and health staffing at the Operations Office indicates that staff vacancies do exist and appear to have contributed to not meeting safety and health program objectives.

ENFORCEMENT AND  
INDEPENDENCE NEEDED

DOE's ability to enforce safety and health standards is handicapped because contractors have no immediate incentive to improve health and safety conditions. The Department does not have a system of fines for safety and health violations. DOE's primary enforcement power is the threat of non-renewal or cancellation of the contract it has with the operators. These methods are neither timely nor effective. (See pp. 27 and 28.)

The dual responsibilities of the Oak Ridge Operations Office--production and safety and health--limit its ability to independently and objectively administer a safety and health program.

Although conscious trade-offs of safety and health concerns for uranium enrichment production goals have not been detected, the structure of the organization detracts from the status and perceived authority of the safety and health program. The closeness of the safety and health program to all phases of contractor relations may have contributed to the Office's over-reliance on the contractor to carry out the safety and health program without adequate Operations Office oversight or monitoring. (See pp. 26 and 27.)

Various alternatives exist to remedy the apparent conflict of interest between safety and health, and production. As a minimum action, the Oak Ridge Operations Office's safety and health organization could become directly responsible to the Oak Ridge Operations Office manager. Further independence

could be provided by removing the safety and health program from Oak Ridge and placing it under a DOE headquarters organization.

A much more drastic alternative would be to allow an outside agency, such as the Nuclear Regulatory Commission or the Department of Labor, to administer the program. This would ensure independence and would provide a system of penalties and fines to increase enforcement ability.

#### RECOMMENDATIONS TO THE SECRETARY OF ENERGY

The problems facing DOE's safety and health program at enrichment plants raise concern about the adequacy and independence of the Department's entire safety and health program. GAO plans to review DOE's entire program in the near future. In the interim, however, GAO believes that several improvements in the health and safety program at enrichment plants should be made.

The Secretary of Energy should:

- Make sure that plant inspections and appraisals are performed as required and that all employees' complaints are investigated and followed up by the Oak Ridge Operations Office.
- Provide greater independence and objectivity in the Oak Ridge Operations Office safety and health program through an organizational change to provide insulation between safety and health concerns and production goals and objectives.

#### RECOMMENDATION TO THE CONGRESS

GAO believes that in order to enhance DOE's ability to enforce safety and health standards and procedures; a program of non-reimbursable fines and penalties, similar to that included in the Occupation Safety and Health Act of 1970, is needed. Therefore, GAO recommends that the Congress authorize the Secretary of Energy to institute a program of non-reimbursable fines and penalties for safety and health violations.

## AGENCY COMMENTS

The Department of Energy disagreed with several aspects of GAO's draft report, commenting principally on its scope and presentation. The Department also suggested several factual clarifications which are included in this report.

Nevertheless, DOE advised GAO that immediate action was being taken to correct the staffing inadequacies at the Oak Ridge Operations Office and to improve the follow up on employee complaints. In addition, the Department said that the organizational location of the Oak Ridge safety and health staff is under review.

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the Department of Energy

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ABBREVIATIONS

AEC Atomic Energy Commission  
DOE Department of Energy  
GAO General Accounting Office  
OSHA Occupational Safety and Health Act

## CHAPTER 1

### INTRODUCTION

In passing the Occupational Safety and Health Act (OSHA) of 1970 (29 U.S.C. 651), the Congress sought to assure safe and healthful working conditions for every worker in the Nation. The act authorized the Secretary of Labor to establish and enforce national occupational safety and health standards. However, the act does not apply to the working conditions of employees with respect to which other Federal agencies are exercising other statutory authorities to prescribe or enforce standards or regulations affecting occupational safety and health. Under this exemption the Department of Energy (DOE), not the Department of Labor, is responsible for establishing and enforcing occupational safety and health standards for both radiological and nonradiological matters at many DOE-owned, contractor-operated facilities, including the Nation's three uranium enrichment plants.

### DESCRIPTION OF URANIUM ENRICHMENT PLANTS

The Government owns three enrichment plants. Those located in Paducah, Kentucky, and Oak Ridge, Tennessee, are operated by the Union Carbide Corporation; the Portsmouth, Ohio, plant is operated by the Goodyear Atomic Corporation.

The primary purpose of the enrichment plants is to provide uranium containing about 2 to 5 percent of the uranium-235 isotope <sup>1</sup>/<sub>for use in nuclear reactors. All three enrichment plants have this capability. In addition, the Portsmouth plant is able to provide uranium enriched to more than 93 percent of uranium-235 for uses in test and research reactors and in the naval reactor and nuclear weapons programs.</sub>

The enrichment process--much like a filtering process--utilizes a gas (uranium hexafluoride) and a porous barrier which allows the lighter uranium-235 to pass through more readily than the heavier uranium-238. The degree of enrichment which can be achieved in a single diffusion through the porous barrier is very small. Thus, the

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<sup>1</sup>/Uranium, as a natural ore, consists of two principal isotopes, uranium-235 (about 0.7 percent of natural uranium), which is fissionable, and uranium-238 (about 99.3 percent of natural uranium), which is not fissionable in a nuclear reaction.

diffusion process must be repeated many times. Because the repetitive nature of the process demands a lot of machinery, these plants are among the largest industrial facilities in the world. About 11,200 people are employed at the three plants; 6,200 at Oak Ridge, 2,700 at Portsmouth, and 2,300 at Paducah.

DOE'S OCCUPATIONAL SAFETY AND  
HEALTH PROGRAM FOR ENRICHMENT  
PLANTS

When OSHA was enacted, the former Atomic Energy Commission (AEC) desired to remain responsible for the occupational safety and health of employees at its Government-owned, contractor-operated facilities. AEC had previously exercised its authority to require safety and health programs at its contractor-operated facilities under the Atomic Energy Act of 1954 (42 U.S.C. 2201). AEC desired to keep such control over the safety and health program primarily because it felt that OSHA's provisions for individual State programs could lead to non-uniform application of standards.

Initially, AEC wanted to consider its facilities as being subject to OSHA, with AEC enforcing compliance under an interagency agreement. AEC and the Department of Labor attempted to negotiate such an arrangement for more than 2 years. However, it was finally determined that State authority could not be excluded if a facility was considered subject to OSHA. Subsequently, AEC decided to exercise its exemption from Department of Labor jurisdiction.

On February 4, 1974, the Department of Labor formally accepted AEC's argument that it had, and was exercising, the required statutory authority to enforce its own occupational safety and health programs at its contractor-operated facilities. DOE has inherited this authority, but the authority extends only to those facilities which DOE operates subject to the Atomic Energy Act of 1954.

Policy, objectives, and organization

DOE's general policy is to provide contractor employees at DOE-owned facilities with safe and healthful working conditions, complying with standards at least as effective as those promulgated under OSHA. Within DOE, overall responsibility for occupational safety and health assurance is assigned to the Assistant Secretary for Environment. The functions of program overview, and developing standards, policies, regulations, procedures, and overall direction are delegated to the Assistant Secretary for Environment's Operational and Environmental Safety Division.

Ensuring that the safety and health program at DOE's facilities is implemented has been assigned to the program offices. The program offices' responsibilities for occupational safety and health at DOE-owned, contractor-operated facilities are dispatched through the DOE field or operations offices. Field responsibility for all three enrichment plants is administered by the Oak Ridge (Tennessee) Operations Office. The Oak Ridge Operations Office has none of its occupational safety and health personnel located at the enrichment plants.

#### SCOPE AND METHODOLOGY OF REVIEW

In response to allegations that the enrichment plants are not being safely operated, the Chairman of the Subcommittee on Energy, Nuclear Proliferation and Federal Services, Senate Committee on Governmental Affairs, requested that we review DOE's safety and health program to determine (1) if its procedures are adequate to ensure the safe operation of uranium enrichment facilities and (2) if such procedures are adequately implemented.

The review was conducted at DOE headquarters in Washington, D.C.; DOE's Oak Ridge Operations Office; the Oak Ridge Gaseous Diffusion Plant; and the Portsmouth Gaseous Diffusion Plant.

In the review, we analyzed DOE's safety and health policies, regulations, and procedures. While DOE's safety and health program includes safety reviews of the design and construction of new facilities, preoperational reviews, and accident investigations, our review focused on the adequacy of the methods (inspections, appraisals, and complaint investigations) DOE uses to ensure that contractors at the enrichment plants implement all DOE safety standards and procedures. We reviewed pertinent formal documents and held discussions with DOE officials, plant (contractor) management, and plant employees. We examined the safety records of the three plants and compared them with national statistics and DOE-wide statistics. In addition, we reviewed 11 major accidents which have occurred at the facilities and reviewed 92 safety and health complaints filed by contractor employees.

To obtain some perspective as to the typicality of the Oak Ridge Operations Office's safety and health program, we held discussions with safety and health personnel at DOE's Nevada and Albuquerque Operations Offices.

## CHAPTER 2

### URANIUM ENRICHMENT PLANTS' SAFETY RECORD

The injury record for the three enrichment plants is better than injury statistics for similar operations, such as the chemical industry. In addition, radiation exposure records for the three plants indicate that employees are receiving less than the maximum allowable doses. However, these plants have experienced a number of serious accidents over the past few years and have also experienced numerous leaks of radioactive materials. Exposures to radiation, in any dose, and radioactive releases to the environment are of particular concern because the long-term effects of radiation and its relation to various forms of cancer are not known.

#### POTENTIAL SAFETY AND HEALTH HAZARDS

As with nearly any production facility, enrichment plants involve some risk of worker injury or death from mechanical operations and industrial hazards. In addition, enrichment plants present several chemical and radiation hazards which are somewhat unique and warrant a brief description.

Many employees at the enrichment plants come in contact with radioactive materials, primarily by handling storage containers or during maintenance. In most cases, protective equipment which greatly limits the employees' exposures is available. The primary radiation hazard at the plants is unanticipated releases of uranium hexafluoride from the enrichment process or from storage.

Releases can result in the inhalation or ingestion of uranium. Exposures to large amounts of radiation can kill a person within a few days. However, according to DOE officials, at lower levels of uranium-235 enrichment, the most damage that an exposed employee would receive would not be due to radioactivity, but due to the heavy metal qualities of uranium. (Heavy metals, such as uranium and lead, damage the urinary system when ingested.)

Uranium hexafluoride, if leaked to the environment, also presents a chemical hazard. It may mix with the moisture found in humid air to form hydrogen fluoride (a very corrosive gas) and uranyl fluoride (a radioactive solid). The hydrogen fluoride gas can severely damage lungs. Uranyl fluoride will dissolve in water and once inhaled or ingested, it can cause organ damage.

There is some potential for achieving nuclear criticality 1/ in an enrichment plant. Criticality has never occurred, however, and DOE officials consider the possibility to be remote, as long as the uranium hexafluoride is maintained as a gas. Nevertheless, criticality detection systems and warning devices are required for the plants.

The Portsmouth plant, which has the capability to produce highly enriched uranium, involves additional hazards. Highly enriched uranium increases the consequences of any accident, injury, or exposure. Additionally, the Portsmouth and Paducah plants include facilities that convert uranium oxide to uranium hexafluoride (although neither facility is currently operating). If inhaled, uranium oxide will not dissolve in water and will remain in the lung indefinitely.

#### WORK-RELATED INJURIES

Contractors collect data related to on-the-job injuries and employee exposures, and provide summaries to DOE. Enrichment plant operations, for comparative purposes, are most similar to the chemical industry. The contractors' data indicate that enrichment plants have a lower injury rate than the chemical industry and that the time lost due to injuries is less than that of the chemical industry. Injury rates for the plants are well below the national average for all industries. The following two charts show the most recent (calendar year 1978) national injury incidence rates, the injury-related days away from work for all industries (including the chemical industry), 2/ as well as the comparable statistics for the three enrichment plants for calendar years 1978 and 1979.

---

1/Criticality is the point at which a fission chain reaction begins. When criticality is reached, an explosion can occur due to rapid expansion and/or vaporization.

2/"Accident Facts, 1979 Edition," National Safety Council.

Recordable Injuries Per 200,000 Employee Hours (note a)

|                          |      |
|--------------------------|------|
| All industry (1978)      | 3.46 |
| Chemical industry (1978) | 1.78 |
| Paducah plant:           |      |
| 1978                     | 0.5  |
| 1979                     | 0.4  |
| Portsmouth plant:        |      |
| 1978                     | 0.4  |
| 1979                     | 0.4  |
| Oak Ridge plant:         |      |
| 1978                     | 0.4  |
| 1979                     | 0.3  |

a/Recordable injuries are those involving lost work time or restricted work time.

Lost Work Days (Due to Injuries)  
Per 200,000 Employee Hours (note a)

|                          |      |
|--------------------------|------|
| All industry (1978)      | 61.0 |
| Chemical industry (1978) | 34.0 |
| Paducah plant:           |      |
| 1978                     | 22.1 |
| 1979                     | 6.5  |
| Portsmouth plant:        |      |
| 1978                     | 9.7  |
| 1979                     | 16.4 |
| Oak Ridge plant:         |      |
| 1978                     | 22.7 |
| 1979                     | 5.8  |

a/Lost work days are restricted days and lost time days.

In order to reduce work-related injuries and comply with OSHA standards, DOE started a program in 1974 to improve the safety of the enrichment plants. When completed, the program will have spent over \$8 million to retrofit the three plants (built 15 to 25 years before OSHA). As of December 31, 1979, the program was about 70 percent completed. Most of the changes involve non-radiological safety concerns such as ventilation, noise abatement, fire prevention, electrical safety, and machine guards.

ACCIDENTS AT ENRICHMENT PLANTS

Eleven major accidents have occurred at the three enrichment plants since 1970. One fatality has resulted, and six accidents resulted in radioactive spills or releases.

DOE has categorized major accidents in two categories: type "A" and type "B." Criteria for a type "A" accident include accidents resulting in

- a fatal injury or illness, or a "lost work day" injury or illness to five or more workers,
- loss or damage of property amounting to \$250,000 or more;
- the release of hazardous pollutants or the loss, theft, or release of materials in hazardous amounts;
- an excessive radiation dose to an employee; and
- unplanned nuclear criticality.

Type "B" accidents are defined as those resulting in property damage between \$100,000 and \$250,000 or a release of radioactive material in excess of standards. A brief description of the type "A" and "B" accidents since 1970 follow.

1. Explosion (Portsmouth; May 19, 1971; type A)

A propane tank owned by a subcontractor ruptured when a leak developed in the base of a propane gas cylinder and was ignited by an undetermined source. Extensive damage occurred to the floor and walls of the building (\$440,000). There was a minor injury as a result of the incident.

2. Radioactive release (Portsmouth; May 2, 1973; type A)

A uranium hexafluoride release occurred as an employee was attempting to take a liquid sample of material from a storage cylinder. The leak, which lasted approximately 20 minutes, resulted in the loss of 215 pounds of uranium. Damage was estimated at about \$13,600; no injuries or exposures resulted.

3. Compressor failure resulting in radioactive release  
(Portsmouth; April 10, 1975; type B)

Failure of an expansion joint resulted in the release of nearly 27 pounds of uranium over a 27 minute period. Two employees were placed on temporary restriction; however, neither was found to have inhaled significant amounts. Damage was estimated at about \$29,000.

4. Radioactive release (Portsmouth; August 6, 1975; type B)

Electrical problems resulted in erratic heating of uranium hexafluoride and a blocked copper tube. The tube ruptured and allowed about 2.9 pounds of uranium (enriched to 97.5 percent uranium-235) to escape over a 5 to 25 minute period. Although 17 workers inhaled more than the permissible amount of uranium, DOE did not consider any to have received a significant dose. Damage was estimated at \$28,310.

5. Valve malfunction resulting in radioactive release (Portsmouth; November 10, 1975; type B)

After an August 5, 1975, release, new operating procedures were implemented but, in this case, were not followed. A connection was made with only one gasket rather than the required two, and when the valve was opened, about 23 pounds of uranium enriched to 97.5 percent uranium-235 escaped. The leak lasted 46 minutes because of inoperable safety equipment. No employees received what was considered to be significant exposures, and total cost of the accident was estimated at \$101,127.

6. Electrical fire (Paducah; December 13, 1976; type B)

A ground fault existed in an electric motor which was not operated in accordance with procedures. The resulting electrical fire damaged about \$72,000 of equipment and slightly injured two firemen.

7. Electrocution (Paducah; February 16, 1977; type A)

An electrician contacted 4,160 volts, partially due to the prior removal of a safety barrier. The electrician was fatally injured and \$55,000 in damage resulted.

8. Explosion and radioactive release (Paducah; January 3, 1978; type B)

A mechanical failure caused an explosion. About 30 pounds of uranium hexafluoride was released. No injuries resulted and damage was estimated at \$200,204.

9. Radioactive release (Portsmouth; March 7, 1978;  
type A)

A vehicle carrying a 14-ton cylinder containing liquid uranium hexafluoride failed. The cylinder was dropped and ruptured, releasing 21,125 pounds of uranium in about 5 minutes. No employees were exposed in excess of maximum limits; damage totaled \$368,350. A report on the accident indicated the vehicle was in extremely poor condition and that many cylinders had been previously dropped. The report also stated that under less favorable conditions, this type of accident would have resulted in injuries and/or fatalities.

10. Electrical explosion (Portsmouth; March 31, 1980;  
type A)

An electrical failure caused an explosion which seriously injured an employee and resulted in \$47,000 damage.

11. Smelter furnace refractory burnthrough (Paducah;  
April 10, 1980; type B)

A refractory burnthrough resulted in property damage of \$47,000. No injuries occurred.

RELEASES OF RADIOACTIVE MATERIALS

While there have been only six releases of radioactive materials which have been classified as type A or type B accidents, operations at the three enrichment plants since the 1940s have resulted in 240 releases of radioactive materials containing 1 kilogram (about 2.2 pounds) or more of uranium. Forty-one of these releases occurred at the Oak Ridge plant; 88 at the Paducah plant; and the remaining 111 at the Portsmouth plant.

In addition, a small number of releases occurred involving uranium oxide and uranyl nitrate. Even so, these figures do not represent every release of radioactive material. Releases of less than 1 kilogram are not included, and a list of such releases is not available for Paducah and Oak Ridge. The Portsmouth plant has experienced about 170 additional releases of between 1 gram and 1 kilogram of uranium.

Causes of such releases vary widely. More than half of the releases at Portsmouth resulted from various mechanical failures, including valve failure and failed lines and gaskets.

About 15 percent of the Portsmouth releases resulted from corrosion (primarily liquid storage cylinders), and 7 percent involved human error. At least six releases resulted from dropped storage cylinders.

#### EMPLOYEE EXPOSURE TO RADIATION

DOE radiation standards are based on a philosophy that radiation exposures are to be maintained as low as reasonably achievable within the radiation limits for employees and the general public. DOE regulations state that assuring that work and public exposure do not exceed the exposure guidelines is insufficient because under DOE policy, operations shall be conducted in a manner to assure that radiation exposures are limited to the lowest levels technically and economically practicable. Basic to this policy is the premise that exposures can be maintained as low as reasonably achievable through the design of a facility or equipment, through state-of-the-art monitoring and protective equipment, and through quality procedures and training. Protection against radiation exposures within enrichment plants can be provided through numerous methods--including ventilating equipment, respiratory protection, protective clothing, warning systems, and proper operation of all equipment.

DOE's radiation standards, the same as those recommended by the National Council for Radiological Protection, 1/ are shown in the following chart.

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1/A non-profit corporation chartered by the Congress in 1964 to, among other things, collect, analyze, develop, and disseminate, in the public interest, information and recommendations about (1) protection against radiation and (2) radiation measurements, quantities, and units, particularly those concerned with radiation protection.

Radiation Protection Standards for  
External and Internal Exposures

| <u>Type of exposure</u>  | <u>Exposure period</u> | <u>Dose equivalent (rems) (note a)</u> |
|--|------------------------|--|
| Whole body, head and trunk, gonads, eye lens, red bone marrow, active blood forming organs | year                   | 5                                      |
|  | quarter                | 3                                      |
| Unlimited areas of the skin and other organs and tissues                                   | year                   | 15                                     |
|  | quarter                | 5                                      |
| Bone   | year                   | 30                                     |
|  | quarter                | 10                                     |
| Forearms   | year                   | 30                                     |
|  | quarter                | 10                                     |
| Hands and feet   | year                   | 75                                     |
|  | quarter                | 25                                     |

a/Dose equivalent is measured in rems. A rem is the radiation energy absorbed by the body multiplied by a factor which compares the biological effect of different types of radiation.

Monitoring for exposures is required for any individual who has the potential to receive a dose in excess of 10 percent of the quarterly or annual standard. Monitoring must be conducted for external radiation--primarily by dosimeters--and internal radiation--primarily by bioassay analysis and in vivo (whole body) monitoring.

Exposure to radiation in excess of the standards requires that the worker be placed on restriction--that is, reassigned to work which will not increase his exposure. Employees are sometimes put on restriction at levels less than the maximum dose equivalent if it is thought he or she may receive additional exposure which would exceed the standard. Placing workers on restriction for less than the maximum level is left to the discretion of the contractor.

Records of exposure are kept by contractors and reported periodically to DOE. We examined exposure records for employees at the three enrichment plants for calendar years 1974 through 1978 and found no record of any individuals whose exposure to radiation exceeded the standard established.

For in vivo exposures--maximum limit of 5 rem--we found no employees reported to have received more than 2 rem. Twenty-four employees had received between 1 and 2 rem; 18 at Portsmouth, 5 at Paducah, and 1 at Oak Ridge.

The maximum dose equivalent for internal body dispositions of radioactive materials varies depending on the organ. According to DOE records, during the period 1974 through 1978, no employee at any of the enrichment plants received more than the maximum limits. Fifteen employees did receive doses exceeding one-half of the limit. Twelve of these employees worked at Portsmouth; the remaining 3 worked at Paducah. All 15 cases involved doses to the lungs. The maximum limit for lungs is 15 rem per year. The highest dose recorded was about 10.9 rem.

As stated previously the long-term effects of any exposures to radiation--even those below allowable standards--are of particular concern. DOE's policy of limiting exposures to as low as practicable mirrors this concern. Many experiences have confirmed that exposure to radiation can increase the incidence of cancer. And although groups of people who have been exposed to radiation occupationally or medically have been studied and observed, important questions remain unanswered about the effects of radiation. Scientists are still trying to understand exactly how radiation causes cancer, and determine how many cancers are caused by a given amount of radiation.

It is interesting to note that the Portsmouth plant employees experienced the highest levels and greatest numbers of exposures. In addition, nearly half the uranium hexafluoride releases and six of the nine major accidents occurred at Portsmouth. DOE officials believe this situation is partially attributable to the processing of highly enriched uranium (which is not done at the Paducah or Oak Ridge plants). DOE also attributed this situation to the backgrounds of the contractors. Union Carbide--the contractor at the Oak Ridge and Paducah plants--is primarily involved in the chemical industry, which has a tradition of being safety conscious. DOE officials informed us that the Goodyear Atomic Corporation has not been as safety conscious in the past, but that the situation has improved.

### CHAPTER 3

#### DOE DOES NOT ADEQUATELY ENFORCE

##### ITS SAFETY AND HEALTH PROGRAM

Establishing standards, procedures, and regulations and ensuring their implementation are essential for providing contractor employees at DOE facilities with safe and healthful working conditions. This is DOE's safety and health program's goal. Onsite implementation of the safety and health program is the contractor's responsibility. Union Carbide Corporation and Goodyear Atomic Corporation have safety and health programs at the enrichment plants, including full-time safety and health personnel. DOE's Oak Ridge Operations Office is responsible for ensuring that the enrichment plant contractors do provide safe and healthful working conditions and adhere to DOE's established standards and procedures.

To ensure that safety and health standards and procedures are implemented properly at existing facilities such as the enrichment plants, DOE's Oak Ridge Operations Office has three primary tools: complaint investigations, inspections, and appraisals. In general, inspections involve physical checks of plant conditions, and appraisals involve reviews of the contractor's safety and health program. Our review indicated that the Oak Ridge Operations Office was not using these tools effectively and, therefore, could not ensure that DOE's safety and health program was being implemented by the contractors.

##### EMPLOYEE SAFETY AND HEALTH COMPLAINTS SHOULD RECEIVE MORE ATTENTION

The complaint procedure is one means by which DOE can learn about the effectiveness of the safety and health program and the actual working conditions at the plants. DOE encourages employees to initially report to the contractor, either directly or through their authorized employee representative, any conditions or practices which they consider detrimental to their safety or health or which they believe are in violation of DOE safety and health standards. Such complaints may be made orally or in writing.

When the operating contractor receives a complaint from an employee, the contractor is required to confer with the employee and arrange for a joint inspection of the condition or circumstances identified in the complaint. If, on the basis of either the inspection or the report on the contractor's disposition of the complaint, the employee feels that the situation has not been remedied, he may file a complaint

with the cognizant DOE operations office. Posters are to be placed in all work areas providing information on the complaint procedures.

When DOE receives an employee complaint, the safety and health staff is to immediately ascertain whether the hazard cited poses imminent danger to employees. If the complaint involves imminent danger and appears to have merit, DOE shall dispatch an inspector to the workplace involved. When an immediate inspection cannot be made, DOE shall contact the contractor immediately, ascertain as many pertinent details as possible concerning the situation, and if necessary, have affected employees removed from the danger area. DOE is to ascertain what steps, if any, the contractor intends to initiate in order to eliminate the danger.

DOE is to conduct an inspection, whether or not the contractor is able to eliminate the danger. If a complaint does not involve imminent danger, DOE is to review the basis of the complaint and, if determined necessary, conduct an inspection within 15 days.

Unless an employee wishes to remain anonymous, DOE must respond, in writing, to each complaint received and provide the results of the inspection or state why no inspection was conducted.

DOE's Oak Ridge Operations Office is the focal point for complaints from the employees at the three enrichment plants. From files at the Oak Ridge Operations Office, we identified 92 complaints filed by enrichment plant employees since DOE's complaint procedures were formulated. Virtually, all the complaints (91 of 92) have been filed since the beginning of 1975. <sup>1/</sup> The following chart shows the distribution of complaints on file by enrichment plant and by year.

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<sup>1/</sup>While interviewing employees, however, we became aware of a few complaints which were filed with the Oak Ridge Operations Office, but were not in their files. After reviewing a draft of this report, DOE's Oak Ridge Operations Office informed us that it identified 125 complaints received. The figures contained in this report, however, still reflect the 92 complaints which we reviewed in detail.

Enrichment Plant

| <u>Calendar</u><br><u>year</u> | <u>Portsmouth</u>                       | <u>Paducah</u> | <u>Oak Ridge</u> |
|--------------------------------|---|----------------|------------------|
|                                | ------(number of complaints filed)----- |                |                  |
| 1973                           | 0                                       | 0              | 1                |
| 1974                           | 0                                       | 0              | 0                |
| 1975                           | 0                                       | 1              | 4                |
| 1976                           | 2                                       | 0              | 5                |
| 1977                           | 5                                       | 1              | 7                |
| 1978                           | <u>b/27</u>                             | 0              | 7                |
| 1979                           | 5                                       | 0              | <u>b/26</u>      |
| 1980 (note a)                  | <u>1</u>                                | <u>0</u>       | <u>0</u>         |
| Total                          | <u>40</u>                               | <u>2</u>       | <u>50</u>        |

a/Through February 5, 1980.

b/The large number of complaints filed by Portsmouth employees during 1978 and by Oak Ridge employees during 1979 reflect groups of employees filing complaints at the same time. On April 17, and 18, 1978, 19 separate complaints were filed by Portsmouth employees. On July 17, 1979, 18 Oak Ridge employees filed complaints. These complaints were not related to single incidents.

Oak Ridge Operations Office safety and health personnel informed us that none of the 92 complaints they received were considered to involve imminent danger to plant employees. Fifty-two 1/ of the 92 complaints resulted in investigations by DOE or the contractor. Only six of the complaints were found to be safety or health violations; however, occupational safety- or health-related changes were recommended in 27 other cases where no violations were found. Thirty-three of the complaints on file involved allegations of danger from radiation.

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1/Eighteen of the complaints were combined in one investigation during July 1979.

Contractors relied on to  
resolve complaints for DOE

DOE's procedures for handling employee complaints encourage employees to seek satisfaction in-house. If the complaint is not resolved in-house, or if for some reason (such as desiring anonymity) the employee does not wish to contact the contractor, he may file a complaint with the Oak Ridge Operations Office. Thus, if an employee files a complaint with the Oak Ridge Operations Office, he is usually indicating that he has exhausted the potential for in-house resolution.

The Oak Ridge Operations Office has, however, requested extensive contractor participation in the investigation of complaints that it has received. Of the 52 complaints filed with the Oak Ridge Operations Office which resulted in site inspections, the Operations Office requested that the contractor handle 11 of the investigations and inspections.

For example, on April 26, 1979, an employee filed a formal complaint with the Oak Ridge Operations Office alleging that proper procedures were not being followed when processing highly enriched material, creating an unsafe condition. On April 30, 1979, an Oak Ridge Operations Office safety and health official phoned the employee and told him that no imminent criticality hazard existed. The employee was referred to the contractor if he desired further discussions. Operations Office files show that the employee declined to meet with contractor management and withdrew his complaint. An Operations Office safety and health official discussed the complaint with contract administration personnel who later contacted the contractor and discovered that 16 employees had been exposed to a release of uranium hexafluoride related to the operations described in the complaint. The contractor agreed to conduct an investigation, addressing the employee's complaint and including a review of the adequacy of adherence to operating procedures and the related nuclear criticality safety implications.

Our conversations with the employee who filed the complaint indicate the employee did not desire to have the contractor conduct the investigation. He stated that his only contact with the Operations Office was a phone call informing him that his complaint was really a financial matter, not a safety matter. He received no letter or followup contact from Oak Ridge. He also stated that he did not agree to drop the complaint but eventually gave up. According to the employee, his only contact with the contractor's

management after the complaint involved his being informed that he did not understand the operation of the system. The employee was not informed by the contractor of the results of its investigation; neither was the Oak Ridge Operations Office aware of the results.

In another case, on March 14, 1978, a Portsmouth employee filed a written complaint, alleging that an emergency valve which shuts off a line when gas is escaping was out of reach for short employees and should be lowered. On the complaint form, the employee stated that the suggestion had been made to management, but that no action had been taken even though management agreed that the valve should be lowered. On March 24, the Oak Ridge Operations Office informed the employee that his complaint had been turned over to the contractor for investigation, and if he was not satisfied, he could contact Oak Ridge for an independent investigation. The letter stated that the employee had agreed to this.

The employee informed us that before filing the complaint with the Oak Ridge Operations Office, he had expressed his concern to his supervisor and the contractor's safety staff. Only after receiving no satisfaction from contractor management did he resort to DOE. The employee informed us that he did not agree to let the contractor investigate and had understood that the Operations Office was going to do it. Contractor safety and health personnel did contact the employee, but the issue has never been resolved to his satisfaction. Oak Ridge did not contact the employee to see if he was satisfied with the contractor's investigation and currently is not aware if the complaint was valid or not.

The DOE complaint procedures provide for an employee to exhaust his options in-house before contacting DOE unless he specifically desires DOE to review the complaint. Under either situation, if a complaint is filed with DOE, the employee's desire for an independent investigation is implicit. In many cases, referral to the contractor only reverts the employee back to a situation from which he previously did not obtain resolution or which he specifically did not desire. If DOE's program is to meet its objective of ensuring the safety and health of all employees, it is imperative that employees be offered objective, independent reviews of their complaints and that the complaints not be recycled to the contractor which may be responsible for the situations giving rise to the complaints.

Lack of followup on recommendations  
made resulting from complaints

Although DOE procedures do not require the Operations Office's staff to follow up on changes recommended as a result of employee complaints, it is a good management practice and essential to an effective safety and health program to do so.

The Oak Ridge Operations Office is not adequately following up on changes recommended as a result of occupational safety and health complaints from employees at enrichment plants. Six of the 92 complaints filed with DOE were found to involve safety and health standards or procedures violations. These violations involved

- handling and tagging (labeling) of contaminated material and lack of response to employee requests for exposure information,
- defective electrical outlets,
- design and procedural deficiencies resulting in excessive airborne dust concentrations,
- excessive airborne nickel concentrations,
- unsafe forklifts, and
- procedural deficiencies resulting in employees being exposed to technitium (a radioactive substance).

Our review indicates that only the recommendation related to fixing unsafe forklifts was specifically monitored by DOE to ensure correction. 1/ The recommendation related to the excessive airborne nickel violation was not formally monitored; however, Oak Ridge Operations Office personnel informed us that they questioned the contractor's industrial hygienist related to the violation and received two letters from the contractor describing the corrective actions that had been taken. Oak Ridge Operations Office safety and health officials informed us that (1) the recommendation related to technitium exposures had been monitored, although no record of such exists and (2) they have had assurance

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1/After reviewing a draft of this report, Oak Ridge Operations Office officials informed us that, subsequent to our review, they formally followed up on the handling and tagging violation.

from the contractor that the airborne dust concentration violations have been corrected.

In addition to the actual violations of safety and health standards or procedures, the Oak Ridge Operations Office made recommendations or suggestions related to 27 additional complaints. The Operations Office failed to follow up on recommendations related to 20 of the complaints, and in only 2 of the remaining 7 cases is there a record of monitoring.

Failure to monitor contractor actions related to safety and health violations or recommendations for improvements results in DOE's not having assurance that the situation which led to the violation or employee complaint will not recur. For example, 5 of the 50 complaints that DOE received from Oak Ridge plant employees involved improper identification of contaminated equipment.

The first of these complaints took place on May 28, 1975, when a complaint was received concerning mis-tagging of a contaminated pump housing which was to be machined. The housing was marked as being contaminated below the level which would require protective equipment for those employees who would work on the housing. A radiological survey showed, however, contamination 15 to 22 times greater than the level indicated on the tag. Oak Ridge Operations Office officials met with the contractor, who agreed to redefine tagging responsibility and criteria.

On August 6, 1975, the same employee filed a similar complaint with DOE concerning an injury which resulted from an employee's working, without protective equipment, on a valve contaminated beyond plant limits. There was no contamination tag on the valve. Oak Ridge Operations Office officials asked the contractor to look into the matter and directed that future procedures require tags on contaminated material. Although a 1976 appraisal addressed the general issue of contamination by noting that the contractor had issued a new procedure, we found no evidence that any attempt was made to verify implementation of the new procedure or correction of the situations occurring in May and August 1975.

A related complaint was filed with DOE on January 2, 1977. Oak Ridge Operations Office officials instructed the contractor to issue written procedures to correct the problem. On April 4, 1979, still another complaint was received, which included concerns related to the tagging of contaminated material. The employee was referred to the contractor for additional training.

Finally on July 7, 1979, 18 formal complaints were filed with DOE. These complaints triggered an investigation which resulted in the Oak Ridge Operations Office's citing the contractor for procedural violations regarding contaminated material handling and tagging. No DOE recommendation resulted, as the contractor had a review underway of the contaminated process materials control program and had plans to implement a training program for front line supervisors.

While no serious exposures or injuries apparently occurred as a result of the tagging problem at the Oak Ridge facilities, the Oak Ridge Operations Office has allowed the problem to exist for nearly 5 years without taking action to ensure that the situations had been corrected or that proper procedures were being implemented. Reliance on contractors to implement DOE recommendations does not appear to be sufficient. Formal, periodic monitoring--including physical inspections--of contractor implementation of DOE recommendations should be required to ensure maximum worker protection.

#### Lack of response to employees filing complaints

DOE procedures require a written DOE response to each contractor employee filing a complaint. The response is to be sent to the employee's home and is to provide the results of the investigation or state why no inspection was made. The Oak Ridge Operations Office did not provide a written response to 27 of the 92 complaints on file. Oak Ridge officials informed us that 10 of the 27 complaints were provided an oral response.

It is important to both employee morale and to DOE's credibility that all contractor employees filing complaints with DOE be provided with a written response. In 17 of the 27 cases without written responses (and in 10 of the 17 without even an oral response), the Oak Ridge Operations Office had made suggestions to the contractor for improvements relating to the complaint. In cases where DOE is at least partially in agreement, it is important to inform the employee of the action taken. In the remaining cases where no suggestions are forwarded to the contractor, it is equally important to inform the employee why no changes were recommended and to inform the employee of his right to appeal the decision made by DOE's safety and health personnel.

SAFETY AND HEALTH  
INSPECTIONS NOT CONDUCTED

Oak Ridge Operations Office safety and health personnel are required to conduct unannounced inspections of the enrichment plants to ensure compliance with appropriate safety and health standards, regulations, and procedures. Inspections are to be performed on a priority basis with respect to the hazards involved and the number of employees affected. Inspections are also to be conducted so that a representative sample of operations (some large buildings, some small buildings, production operations, construction operations, etc.) of each plant are inspected every year.

Oak Ridge safety and health officials informed us that the objective of the inspection is to provide a visual check to ensure that proper safety and health procedures are being followed and all safety and health protective devices are in place and operable. Employees are to be given an opportunity to have a representative accompany the DOE inspector. The inspector may consult with any employee at any time. Inspections focus on industrial safety (e.g., hand railings, electrical safety, machinery guards). The Oak Ridge Operations Office does not, as part of an inspection or any other visit to an enrichment plant, monitor for radiological contamination.

As of February 5, 1980, DOE's Oak Ridge Operations Office had not conducted an inspection at an enrichment plant for nearly 2 years. 1/ Dates of the most recent inspection at the plants are:

January 18, 1977 - Portsmouth  
September 9, 1977 - Oak Ridge  
February 16, 1978 - Paducah

At the Oak Ridge and Paducah plants, the previous inspections were conducted in 1975 and 1976, respectively.

In not conducting inspections, DOE cannot maintain awareness of potential hazards and take prompt action to eliminate or mitigate the risk of accident. The March 7, 1978, release of more than 10 tons of liquid uranium hexafluoride from a ruptured storage cylinder at the Portsmouth

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1/While reviewing a draft of this report, Oak Ridge Operations Office personnel stated that they had conducted two inspections--one at Oak Ridge and one at Portsmouth--subsequent to our review work.

plant may have been avoided had DOE's Oak Ridge Operations Office conducted onsite inspections and discussed safety and health concerns with employees. The cylinder ruptured when it was dropped from a vehicle (straddle carrier) transporting it. DOE's subsequent investigation of the accident revealed that dropped storage cylinders occur so frequently that they are not even reported unless damage results.

Had DOE conducted inspections, interviews with plant employees should have revealed this potential hazard. Even without employees revealing this problem, adequate knowledge of documented plant occurrences and the related reports should have triggered an inspection of the vehicles. Inspections conducted on a regular basis, with adequate contact with contractor employees and adequate knowledge of current problems, should have revealed this repeated and potentially dangerous problem. Action taken to correct this problem may have averted a \$365,350 accident which, according to the DOE investigation, had potential for injuries or fatalities.

Oak Ridge Operations Office officials informed us that, due to staff shortages, they were forced to prioritize their work and as a result, inspections were not conducted. The staffing of the safety and health program at the Oak Ridge Operations Office is discussed on page 25. Oak Ridge officials also indicated that they believe their appraisal program mitigates the effect of not conducting inspections.

#### APPRAISALS SHOULD FOCUS ON PROBLEM AREAS

In lieu of inspections, the Oak Ridge Operations Office is relying heavily on its appraisals of contractors' safety and health programs to ensure employee protection and contractor compliance with appropriate standards and regulations. DOE's appraisal program is designed to test the adequacy of the contractor's system to accomplish DOE objectives. The Oak Ridge Operations Office conducts a number of different types of appraisals in the safety and health area. Those of direct interest to our review include health physics (radiation), industrial safety, industrial hygiene, nuclear criticality and transportation, and fire protection. DOE headquarters also conducts appraisals of the contractor's medical program.

There is no established frequency or scope for conducting appraisals. Oak Ridge Operations Office safety and health officials told us that they believed that, as a minimum, health physics and industrial safety appraisals should be conducted annually.

We found, however, that the Oak Ridge Operations Office's appraisals of safety and health programs at enrichment plants are not adequate for ensuring proper implementation of safety and health policies and procedures. Appraisals are conducted too infrequently and do not provide adequate coverage to fill the void created by the lack of inspections.

The Oak Ridge Operations Office has appraised the Paducah plant most frequently. Health physics and industrial safety appraisals were conducted in 1978 and 1979, respectively. However, there has not been a nuclear criticality and transportation safety appraisal or a medical appraisal (conducted by DOE headquarters) since 1975.

The Portsmouth and Oak Ridge plants have not been appraised as frequently. Portsmouth has not been appraised for nuclear criticality and transportation safety since 1975. The Oak Ridge enrichment plant has not been appraised for health physics or nuclear criticality and transportation safety since 1977. 1/

Oak Ridge Operations Office officials informed us that they do not believe appraisals should include specific problem areas identified in employee complaints or by other mechanisms. We believe, to be effective, appraisals of the most likely problem areas must be conducted. The Oak Ridge Operations Office's appraisals do not appear to be responsive to ongoing problems. For example, the Operations Office received two complaints concerning mislabeling or lack of labeling to warn employees of contaminated equipment at the Oak Ridge plant. Although the Operations Office agreed that a problem existed and suggested that the contractor establish and implement new procedures, the Operations Office's next health protection appraisal did not include a review of this area. The appraisal did mention that the contractor had issued a new procedure on that subject, but did not verify its implementation or correction of the situation noted in the complaints. Sometime later, a similar complaint at this plant was again received by the Oak Ridge Operations Office. DOE's health protection appraisal conducted after this third complaint again did not address this problem area.

In another example, the lack of inspections and inadequacy of appraisals allowed a situation to exist for

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1/The Oak Ridge Operations Office conducted nuclear criticality and transportation safety appraisals at Oak Ridge and Paducah and a health physics appraisal at Oak Ridge subsequent to our review.

nearly 1-1/2 years before corrective action was taken. On October 24, 1978, contractor safety and health personnel at the Portsmouth plant issued a report which stated that one area of a building was highly contaminated. The report recommended that the area be classified as a "red job" area <sup>1/</sup> and that decontamination procedures begin. The contractor took no immediate action. In September 1979, the contractor's safety and health staff again found the area to be contaminated and made the same recommendation contained in their earlier report. The contractor again took no action. Oak Ridge Operations Office safety and health officials informed us that they were aware of the contamination problem but thought that corrective action was underway. They also indicated that the decision to operate the area as a "red" area would be a management decision. Discussion with employees working in the contaminated area revealed that they were not aware of the contamination.

Finally, in January 3, 1980, an employee was told of the results of the September 1979 contamination survey. On January 7, 1980, the Oil, Chemical and Atomic Workers Union requested that the area be designated as a "red job" area. The contractor refused, citing a contamination survey conducted by the contractor's production group which showed contamination below the "red job" level. The union requested a copy of the production group's survey but was refused, even though DOE regulations require that such surveys be available to employees. On January 22, 1980, the union filed a complaint with the Oak Ridge Operations Office which, after investigation, determined that the area should be designated as a "red job" area and that decontamination should begin.

DOE appraisals or inspections should have revealed this problem. Knowing of the contamination, appraisals should have included reviewing decontamination procedures underway. This effort would have revealed the contractor's lack of action. In addition, inspections which included radiation monitoring in addition to non-radiological safety and health concerns could have revealed the continuing contamination levels. Inspectors, aware of the contamination problem, could also have learned of the contractor's lack of action by interviewing plant employees in the contaminated area.

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<sup>1/</sup>A "red job" area involves the issuance of company-owned protective clothing, additional shower time, etc., to avoid the contamination of employees and the spread of the contamination from the "red job" area.

DOE LACKS ADEQUATE STAFF TO FULFILL  
SAFETY AND HEALTH RESPONSIBILITIES

Regarding both the lack of inspections and the lack of appraisal coverage, Oak Ridge Operations Office officials agreed that adequate coverage has not been achieved. They cited inadequate staffing as the primary impediment to fulfilling their responsibilities.

A review of the Oak Ridge Operations Office's Safety and Environmental Control Division indicates that this claim may have some merit. A review of Operations Office documents indicates that since 1977, inspections and appraisals were scheduled to be performed. The cancellation of the scheduled inspections and appraisals appears to at least partially correlate to the number of staff vacancies. Since June 1978, this division has been continuously staffed by at least two and as many as five professionals less than the authorized ceiling. In January 1980, the division had five authorized positions vacant: a facilities safety engineer, an industrial hygienist, a health protection specialist, a safety engineer, and a fire protection specialist. This situation was further aggravated in the spring of 1980 when the division lost a health physicist and the Assistant Manager for Administration deferred recruitment for three vacant positions (safety engineer, facility safety engineer, and industrial hygienist).

Officials in the Division of Safety and Environmental Control informed us that they believe a contributing factor to two of the positions (fire protection specialist and safety engineer) remaining vacant is that the positions have been evaluated by the Oak Ridge Operations Office at one grade level (civil service general schedule) lower than similar positions in other DOE operations offices. We found this situation to be true, at least in comparison to the Albuquerque and Nevada Operations Offices. DOE headquarters officials informed us that each operations office is responsible for determining its own grade structure.

## CHAPTER 4

### INDEPENDENCE AND ENFORCEMENT AUTHORITY NEEDED

#### IN DOE'S SAFETY AND HEALTH PROGRAM

The Oak Ridge Operations Office is responsible for the production of enriched uranium as well as the safety and health of the contractor's employees. Such a dual role presents the Oak Ridge Operations Office with conflicting goals and may compromise independent and objective implementation of safety and health standards. In addition, while DOE and the Oak Ridge Operations Office are responsible for ensuring the safety and health of the enrichment plant employees, they cannot apply penalties or comparable leverage to require the contractors to comply with their recommendations, suggestions, requirements, or standards.

#### DOE'S SAFETY AND HEALTH PROGRAM NEEDS MORE INDEPENDENCE

DOE has delegated responsibility for the safety and health program for enrichment plants to the Manager of the Oak Ridge Operations Office. The Manager is, however, at the same time responsible for production at the enrichment plants. Within the Oak Ridge Operations Office, production responsibility for the plants has been further delegated to the Assistant Manager for Enriching Operations and specifically to the Enriching Operations Division. This division administers the contracts for operating the gaseous diffusion plants.

The Oak Ridge Operations Office's safety and health program is organized under the Assistant Manager for Manufacturing and Support. As the title implies, the safety and health group is a support organization, and all safety and health matters involving the enrichment plants, including correspondence, reports, and recommendations, are channeled through and under the signature of the Director of the Enriching Operations Division.

This arrangement combines, in one office, responsibility for production and its associated goals, objectives, and costs as well as safety and health goals, objectives, and enforcement. We found no evidence that safety and health concerns were supplanted by production concerns, and both Oak Ridge Operations Office Enriching Operations and safety and health officials assured us that safety and health concerns are not traded for increased production or lower costs. However, we are concerned that the goals and objectives of production may conflict with those of safety

and health and that a safety problem may be viewed from a production-oriented perspective.

A comparison of the organization charts of other operations offices shows no uniform pattern. The placement of the safety and health program at the Albuquerque Operations Office is similar to Oak Ridge's. At the Nevada Operations Office, the Director of the Office of Safety and Health reports directly to the Manager of the Operations Office. At least visually, the arrangement at the Nevada Operations Office provides for increased separation, insulation, and independence of the safety and health function.

#### PENALTIES NEEDED TO STRENGTHEN ENFORCEMENT

The Oak Ridge Operations Office has no authority to fine contractors for occupational safety or health violations. The primary leverage which the Oak Ridge Operations Office can apply to operating contractors to bring about compliance with safety and health standards and the cessation of violations is through the contract. The contracts for operating each of the enrichment plants stipulates that the contractor will operate the plant as directed, observing all DOE regulations and standards. Because all costs, including costs of modifications for increased safety, are reimbursable to the contractor, DOE officials believe the contractor has motivation to comply with all safety and health standards. If the contractor does not comply to the satisfaction of DOE, the contract may not be renewed or, according to Oak Ridge Operations Office officials, the contract could be cancelled. DOE officials cited the non-renewal of the contract at the Rocky Flats (Colorado) DOE facility as resulting partially from safety concerns. We believe, however, that non-renewal or cancellation of contracts do not provide the contractor with an immediate incentive to correct safety or health violations. In addition, other factors such as production performance would certainly be considered and possibly override any such actions.

Oak Ridge Operations Office officials describe their more immediate compliance leverage as the cost plus award fee contract. This type of contract involves reimbursing all contractor costs and paying a fee, or profit, to the contractor, based on its performance. The performance fee is based on various criteria, including production and safety criteria, but this type of contract is currently used only for the Portsmouth plant. The Paducah and Oak Ridge enrichment plants are operating under a cost plus fixed fee contract, whereby the contractor is paid a fee

for the contract period which has been established by prior negotiations between the contractor and DOE.

The cost plus award fee contract for operation of the Portsmouth plant is limited in its potential effectiveness as a penalty for non-compliance. Only 6 percent of the total award fee is dependent on safety or health compliance. This is further diluted as the 6 percent is divided between the medical program, industrial safety, health physics, fire protection, transportation safety, etc. Thus, a safety violation or non-compliance with a recommendation in any specific safety or health area has little, if any, effect on the contractor's overall fee.

In comparison, OSHA provides that the Department of Labor may assess civil penalties of up to \$10,000 per violation for willfully or repeatedly violating safety and health standards. Fines of up to \$1,000 per violation may be assessed for individual safety or health violations, and fines of up to \$1,000 per day may be assessed for failure to correct a violation. DOE has no system of fines comparable to any which the Department of Labor uses.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

DOE-owned, contractor-operated facilities inherited from AEC are exempt from coverage under OSHA. As such, employees at DOE's three enrichment plants must rely solely on DOE to ensure that the operating contractors provide safe and healthful working conditions. To ensure implementation of safety and health standards and procedures at existing facilities such as enrichment plants, DOE has established a program which includes three layers of oversight. DOE requires that its operations offices conduct annual inspections of plant conditions, periodic appraisals of the quality of the contractors' safety and health programs, and prompt investigation and response to employee complaints. This system, if properly implemented, is designed to provide safety and health protection for employees at DOE facilities.

We found that the Oak Ridge Operations Office's implementation of this three-layered program at the three enrichment plants has not met its goals. DOE's procedures for handling employee complaints--the first layer--require investigations and prompt responses to legitimate employee complaints. DOE's Oak Ridge Operations Office, however, has relied on contractors to handle complaints which the contractor has already refused to resolve or which they may have caused. The Operations Office has, in some cases, failed to inform complainants of violations found and corrective action underway as a result of the complaints. Where the complaint was not found valid, DOE often failed to inform the complainant as to why he was wrong or of his right to appeal the findings. In addition, the Oak Ridge Operations Office has failed to follow up on recommendations or changes suggested resulting from employee complaints. This has resulted in continuing problems in some areas which may have been avoided if DOE had monitored the contractor's corrective action.

Inspections--a second layer--are important to ensure the physical safety of the plants and are required to be conducted annually. The Oak Ridge Operations Office has conducted only five inspections of the three enrichment plants during the past 4 years. When inspections have been conducted, they have not included radiological monitoring of plant conditions.

Appraisals--the third layer--have been conducted more frequently than inspections. But appraisals have not been performed as often as necessary to ensure employees safe

and healthful working conditions. In addition, appraisals of the adequacy of contractors' safety and health programs have not focused on major problem areas, many of which had been identified in employee complaints.

While the effects of not performing inspections and conducting inadequate appraisals has thus far not resulted in serious injuries, several of the major accidents and leaks of radioactive material which could have caused serious injuries or fatalities may have been prevented if DOE's Oak Ridge Operations Office had adequately monitored the contractors safety and health efforts and conducted on-site inspections of working conditions.

Safety statistics indicate that the enrichment plants are safer than most industrial operations. We are concerned, though, because several major accidents which may have been avoided have occurred and have released enough radioactive material to injure or kill employees. In addition, the enrichment plants have had several hundred releases of radioactive material. Because the exact correlation between low-level exposures or number of exposures to illnesses such as cancer is unknown, caution requires that even low-level exposures should be avoided, if possible.

DOE's ability to enforce safety and health standards on its contractors is also an area for concern. DOE does not have a system of fines for safety and health violations, and its primary enforcement methods relate to the contract with the operators. The impact of these methods is delayed, however, and the safety and health impact is not substantial.

The present structure and operation of the Operations Office combines production with safety and health to interface with the contractor as one entity. While conscious trade-offs of safety and health concerns for production goals have not been detected, the oneness of the organization, at a minimum, detracts from the status and perceived authority of the safety and health program. The closeness of the safety and health program to all phases of contractor relations may have also led to situations where DOE relies on the contractor to carry out DOE's safety and health program without adequate DOE monitoring or oversight.

Various alternatives exist to remedy the apparent conflict of interest between safety, health, and production. As a minimum action, the Oak Ridge safety and health organization could become directly responsible to the Oak Ridge Operations Office Manager. While this would be an improvement, the Manager is, however, still also responsible for production. Further insulation from production could be

provided by removing the control of the safety and health program from Oak Ridge and placing the program under a DOE headquarters organization (i.e., the Assistant Secretary for Environment, Division of Operational and Environmental Safety).

The ultimate, and somewhat more drastic method of ensuring program independence is to allow an outside agency, such as the Nuclear Regulatory Commission or the Department of Labor, to administer the safety program. 1/

#### RECOMMENDATIONS TO THE SECRETARY OF ENERGY

The problems indicated by our review of DOE's safety and health program at enrichment plants give rise to concern about the adequacy and independence of DOE's entire safety and health program. We are going to review that program in the near future. In the interim, however, we believe that several improvements should be made which would benefit implementation of the program at enrichment plants.

Because the safety and health program at the Oak Ridge Operations Office is not being adequately implemented, we recommend that the Secretary of Energy take action to ensure that inspections and appraisals are performed as DOE's procedures require, and that all employee complaints from these facilities are investigated and followed up on by DOE's Oak Ridge Operations Office. We also recommend that the Secretary of Energy take action to provide increased independence and objectivity in the Oak Ridge Operations Office's safety and health program. Such action could be in the form of an organizational change to provide insulation between safety and health concerns and production goals and objectives.

#### RECOMMENDATION TO THE CONGRESS

GAO believes that in order to enhance DOE's ability to enforce safety and health standards and procedures, a program of non-reimbursable fines and penalties, similar

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1/To transfer this responsibility to the Nuclear Regulatory Commission would require legislative changes. The Congress would have to rescind DOE's present authority and establish new authority with the Nuclear Regulatory Commission. Before the Department of Labor could administer the safety and health program, either DOE would have to agree not to exercise its present authority or the Congress would have to rescind DOE's present authority.

to that included in the Occupation Safety and Health Act of 1970, is needed. Therefore, GAO recommends that the Congress authorize the Secretary of Energy to institute a program of non-reimbursable fines and penalties for safety and health violations.

#### AGENCY COMMENTS

DOE reviewed a draft of this report, and a copy of the Department's comments is included as appendix I. We are pleased to note that DOE states it has taken action to correct the staffing inadequacies at the Oak Ridge Operations Office and to improve the follow up on employee complaints. The Department also advised us that the organizational location of the Oak Ridge safety and health staff is under review. However, DOE did not agree with several aspects of this report. In commenting on the report, DOE expressed the following major concerns:

- The title of the report does not accurately describe the scope of the report. 1/
- The report concentrates solely on the Department's safety and health program, and comparison with other agency's programs is not valid.
- The report fails to recognize the strengths of the Department's program such as design reviews, pre-operational reviews, and continual interface with contractors.
- The report fails to recognize that the Department's safety system does not operate in a regulatory atmosphere but instead operates under the concept that the Department's responsibility is to identify safety objectives and the contractor is to develop and implement methods of meeting these objectives.
- The enrichment plants operate far below approved radiation limits, and the report's discussion of the effects of radiation should not be included.
- Releases of uranium hexafluoride are not considered to be of high hazard and, given the vast amount of

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1/The title of this report has changed since the draft was reviewed by DOE. Although changed to more accurately reflect the contents of the report, the title was not changed to that suggested by DOE. (See app. I, p. 34.)

material handled, the record of releases is not unfavorable.

Our report focuses on the three major tools DOE uses to ensure that safety and health standards and procedures are being observed and implemented at enrichment plants. As such, our work did not include an evaluation of other programs (such as the Department of Labor's) and statements in the report which may have implied comparative evaluations have been deleted. The report does not include other aspects of DOE's program such as design reviews or preoperational safety reviews because these functions bear little relationship to the Department's oversight responsibilities for enrichment plants which have been operating for about 30 years.

We believe this report does recognize that the Oak Ridge Operations Office's safety effort relies on the contractor for compliance with DOE's goals and objectives rather than assuming a regulatory role. The report's recommendation that the Oak Ridge safety and health staff be insulated and independent from production and operation concerns should provide more of the "regulatory atmosphere" we believe is needed to ensure contractor compliance with the Department's safety program.

While it is recognized in this report that the three enrichment plants operate below approved radiation levels and releases of radioactive materials from these plants are generally not considered a high hazard, we are concerned, nevertheless, because the effect of exposures to low levels of radiation is not known. Therefore, exposures to radiation from releases or accidents which can be avoided, should be avoided.

DOE's program provides appraisals, inspections, and complaint investigations as a means to identify potential problems. Complete implementation of that program is essential to reach the Department's goal of limiting exposures to "as low as reasonably achievable."

DOE also provided updated injury statistics and a more precise description relating to the Department's exemption from the Occupational Safety and Health Act of 1970. Changes were made to the report to reflect this information.



Department of Energy  
Washington, D.C. 20585

JUN 12 1980

Mr. J. Dexter Peach  
Energy and Minerals Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Peach:

The Department of Energy staff has reviewed your draft report EMD-80-78 and as discussed during the Department of Energy - General Accounting Office meeting on June 3, 1980, recommends that the report be substantially revised. We offer the following comments for your consideration.

1. To more appropriately describe the extent of the study it is suggested that the title be changed to: "An Evaluation of the Implementation of the Department of Energy's Occupational Safety and Health Program at the Uranium Enrichment Plants."
2. We understand that the report does not purport to be a comparison of the Department's safety program with the programs of either the Department of Labor or the Nuclear Regulatory Commission. In our opinion, the extent of your review is limited to two principal areas:
  - a. the record of injuries and illnesses at the enrichment plants as compared to a comparable industry group, and
  - b. Oak Ridge's degree of compliance with the Department's requirements.

Sections of the report give the appearance that the performance of the Oak Ridge Office is being measured against some presumed level of effort by the regulatory agencies. Since the regulatory agencies were not studied, we believe it is not valid to make such comparisons.

3. A more complete review of Department of Energy requirements to ensure safety should be made and the Oak Ridge performance in all safety areas should be measured. Within the Department's safety program, minimum standards are established which include the

(See GAO note, p. 37.)

Department of Labor's requirements; a safety analysis system is in place which requires a careful review of the design of a facility; preoperational checks are made; there is continuing contact with contractor counterparts; quality and reliability assurance programs support safety; formal safety and health appraisals are made; and accidents are reported and thoroughly investigated. An additional component of the program, added after the passage of the Occupational Safety and Health Act, provides for employee participation in inspections and permits the direct filing of complaints with the Department of Energy. The report is distorted because it focuses only on the inspections, appraisals, and response to complaint aspects of the Oak Ridge program. An evaluation of the Oak Ridge strengths as well as weaknesses would give a more valid perspective to the report.

4. In our systems approach to safety, we rely on the recognition of safety as a line function within each contractor's organization while the Department of Energy provides surveillance of safety as well as program and management functions through continuing performance evaluation. The Department of Energy, in its safety role, does not operate strictly in a regulatory atmosphere. The system operates on the concept that the Department identifies the objectives to the contractor and the contractor develops the various means of meeting the objectives. It is, therefore, the contractor's expertise and staff which are relied upon to develop and execute the programs under the direction and consent of the Operations Office. Accordingly, the small Operations Office staff is working daily with the contractors' staff and assisting in the establishment of priorities and the identification of needed resources. This is in sharp contrast to the relationship between a regulatory agency and private industry especially when one recognizes that it is primarily only during the inspection process that the regulatory agency becomes intimately knowledgeable with what is happening at the plants, and that the industry being regulated is motivated by profit.
5. A major basis used in the GAO report, and endorsed by the Department of Energy, for the determination of whether or not the operations of the enrichment plants have been conducted safely, is a comparison of plant accident statistics with those of the chemical industry and all industry. The record of the enrichment plants over a lengthy period, and currently, is far better than the chemical industry or industry generally.

Through a misunderstanding the All Industry and Chemical Industry incident rates (see "Accident Facts, 1979 Edition," National Safety Council) used in your draft report were taken from the column labelled "Cases Involving Days Away From Work and Deaths" while the rates for the three plants are "Total Lost Workday Cases." A

similar error was made in the second table on page 6. Also, the plant figures shown in the report were correct at the time you conducted the survey; however, since then a final 1978, and an interim 1979, adjustments have been made. The corrected statistics are reflected below:

Total Lost Workday Cases<sup>1/</sup> Per 200,000 Employee Hours

|                          |      |
|--------------------------|------|
| All Industry (1978)      | 3.46 |
| Chemical Industry (1978) | 1.78 |
| Paducah Plant            |      |
| 1978                     | 0.5  |
| 1979                     | 0.4  |
| Portsmouth Plant         |      |
| 1978                     | 0.4  |
| 1979                     | 0.4  |
| Oak Ridge Plant          |      |
| 1978                     | 0.4  |
| 1979                     | 0.3  |

Total Lost Work Days<sup>2/</sup> (Due to Injuries) Per 200,000 Employee Hours

|                          |      |
|--------------------------|------|
| All Industry (1978)      | 61.0 |
| Chemical Industry (1978) | 34.0 |
| Paducah Plant            |      |
| 1978                     | 22.1 |
| 1979                     | 6.5  |
| Portsmouth Plant         |      |
| 1978                     | 9.7  |
| 1979                     | 16.4 |
| Oak Ridge Plant          |      |
| 1978                     | 22.7 |
| 1979                     | 5.8  |

<sup>1/</sup> Total Lost Workday Cases includes injury cases which involve days away from work and days of restricted work activity.

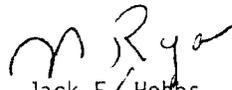
<sup>2/</sup> Total Lost Work Days include days away from work and days of restricted work activity.

6. There are Federally approved standards for occupational exposure to ionizing radiation and the enrichment plants have been operating far below the approved limits. Any discussion of the effects of exposures to levels of radiation far below the limits would seem to be beyond the scope and technical depth of the study and should not be pursued.
7. A major issue is made of the number of releases of UF<sub>6</sub> that have occurred at the plants. The safety significance of the release of material from any process operation will depend on the hazard of the material. In the enrichment process the material is not considered to be of high hazard and this fact should be borne in mind when considering the UF<sub>6</sub> releases. The hazard involved does not require a zero release criterion and, consequently, the system was not designed for one. A listing of plant statistics (i.e., about 30,000 cylinder connects and disconnects per year; 400 miles of piping, etc.) would be helpful to the reader of the report in putting the Department's UF<sub>6</sub> release experience in perspective.
8. With respect to the discussion on page 2 regarding the Department of Energy's authority for regulating safety and health at the enrichment plants, we suggest that you correct it in accordance with the version provided separately by our counsel. It is our understanding that you plan to obtain an opinion from General Accounting Office's counsel as to whether or not the Department has the authority to levy fines against its contractors, since our counsel doubts if such authority exists.

Generally we would not comment on your recommendations until the receipt of your final report. In this case, however, we wish to advise you that we are taking immediate action to correct the staffing inadequacies which exist at Oak Ridge. We have also taken action to improve the follow up on employee complaints and are reviewing the matter of location of the Oak Ridge safety and health staff.

We appreciate this opportunity to comment on the draft report. Various offices in the Department of Energy have developed specific additional information which has been provided to you separately.

Sincerely,

  
for Jack E. Hobbs  
Controller

GAO note: Page references were changed to reflect their location in this final report.

(301549)





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